Lesser Stag Beetles *Dorcus parallelipipedus* (L.) (Coleoptera: Lucanidae) longevity – at least three years

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Introduction

This is a report on further Lesser Stag Beetle *Dorcus parallelipipedus* (L.) studies. It follows a sugaring for stag beetles experiment which was conceived by PH and focused on the Stag Beetle *Lucanus cervus* (L.). However, this study brought unexpected information about the largely overlooked Lesser Stag Beetle: mainly, that it fed much more assiduously than *L. cervus*, was rather sedentary and lived for at least two years (Fremlin & Hendriks, 2011). These two stag beetles seem to have rather different life histories: *L. cervus* lays eggs underground, near or in decayed wood of stumps (Harvey *et al.*, 2011), and sometimes even in leaf mould and compost (MF, pers. obs.). It spends its larval stage in wood or humus, or moving from one to the other, and pupates in the soil (Hendriks & Fremlin, 2012). *D. parallelipipedus* lays eggs in the wood where it spends the larval and pupal stages. Both species pupate in the summer and the adults overwinter in a torpid state in their pupal cells until the next spring when they become active. Whereas *L. cervus* lives only two to three months (Harvey *et al.*, 2011; Klausnitzer & Sprecher-Uebersax, 2008; pers. observations), we found that *D. parallelipipedus* may live for at least a couple of seasons, mostly inside the wood.

The main objectives of our *D. parallelipipedus* 2011 research were to repeat the field work and rearing trials in order to find out more about its longevity, and to continue studying the females' fertility and feeding behaviour in captivity.

Methods

1. Field work

The study area was situated in suburban Colchester, Essex; it measured roughly 40 x 210 m. This area was monitored by MF, daily from 09.30 pm (British Summer Time) from 5 May till 10 August 2011. The field work

consisted of a repetition of the previous season's (Fremlin & Hendriks, 2011), with the inclusion in the monitored area of an old *Acer negundo* tree.

Thus the main habitats monitored were the following:

1.1 A couple of Cherry *Prunus* sp. stumps in MF's garden, TL986244, which have been host to *L. cervus* and *D. parallelipipedus* for several years. The original cloth patches on the cherry stumps, still *in situ*, were loaded daily, late afternoon, with maple syrup as in the previous years. The fungi associated with this habitat are: *Ganoderma* sp., left stump, *Laetiporus sulphureus*, right stump and *Xylaria polymorpha* on the wood piled at their base.

1.2 A rather old Box Elder *Acer negundo* in a front garden was included in the experiment. This was done because at the beginning of the season on 6 May, a Lesser Stag Beetle climbed over it and promptly disappeared into a gap in the bark. This was noticed when MF photographed a *Polyporus squamosus* on the trunk of this tree where there is also a good colony of *Trametes* sp.; in the past, *Armillaria mellea* has also fruited on it.

However, due to access difficulties, most of the beetles on that tree trunk could not be captured.

Otherwise, all Stag Beetles on the patches and elsewhere in the area were captured, measured, weighed, marked and released exactly as in previous years. The exception was that the numbering of the Lesser Stag Beetles carried on from 2010 in order to avoid overlapping them with the previous season's beetles (Fremlin & Hendriks, 2011). The days between recaptures were calculated on the Date-to-Date calculator in the website Time and Date, http://www.timeanddate.com/.

2. Rearing trials

Two male Lesser Stag Beetles were caught in Teuven, Belgium, on 05/08/2009. Both were in a standing beech *Fagus sylvatica* trunk. Two female Lesser Stag Beetles were caught inside their pupal cells in a poplar stem *Populus* sp. lying on the ground in Diesfordt, Germany, on 20/10/2009.

They were kept indoors as well as outdoors in a terrarium, 30 x 20 x 20 cm, with thick white-rotted branches with a diameter of approximately 12 cm. The branches were placed on a 5 to 10 cm thick layer of decayed wood chips. These Lesser Stag Beetles were fed with maple syrup (brand: Horizon, A quality). This syrup was sprinkled on a piece of towel cloth (5 x 5 cm) which was placed in the terrarium. The beetles could feed on

it at will. The cloth with syrup was washed with water every three days and the syrup refreshed. The carcass of a dead female Stag Beetle *L. cervus* was placed in the terrarium for a few days.

Results

1. Field work

The spring in 2011 was unusually warm. In response to that, monitoring started earlier than usual, 5th May; on the next day *D. parallelipipedus* were out in the open and on the following one *L. cervus* males were on the wing.

1.1 Cherry tree stumps

The total number of *D. parallelipipedus* sightings in this habitat has remained stable over the three-year period, just over 50; all are shown in Table 1 to ease comparison. The feeding behaviour of *D. parallelipipedus* in 2011 matched the 2010 observations. That is, far more males than females were sighted at the patches, 32 versus one. As in previous years, quite often the beetles were underneath the patch rather than on top.

L. cervus also visited the patches and behaved the same way as before: the males turned up at the beginning of the season, and the females at the end of it. Their total sugaring sightings were 11 males and two females.

The first sighting on the patches was on the fifth day of the season: a male Lesser Stag Beetle from 2009, 666 days from when it was first captured, exactly on the same syrup patch. It was rather dusty and a bit slow, Figure 1. MF never saw it again; during the three year's study it was recaptured 11 times, of which nine times were during the previous year. Unfortunately, there is no photo for 2009, but he had a distinct large puncture on the left elytron (wing case) and there was no male with the same number during 2010.

Shortly after that, two more old males were captured feeding; respectively, 293 and 358 days after their first capture in 2010. The former was recaptured six more times, a total of 355 days. And the latter turned up ten more times, a total of 420 days; at the end of it he was still very frisky.

Other new assiduous sugaring residents were three males; one was recaptured five times in the space of 20 days, another individual six times during 48 days and, lastly, one 11 times in 30 days. The most interesting feeding recapture was of a male from the *Acer negundo*; he travelled 165 m in a direct line, 15 days after his first capture.

	16 May – 9 September 2009				16 May – 5 September 2010				5 May – 23 June, and 3 July – 10 August 2011				
	No. of marked beetles	Sightings in the monitored area	Total sightings by the cherry stumps	Sightings on the syrup patches	No. of marked beetles	Sightings in the monitored area	Total sightings by the cherry stumps	Sightings on the syrup patches	No. of marked beetles	Sightings in the monitored area	Total sightings by the cherry stumps	Sightings on the syrup patches	Total sightings by the *Acer negundo*
Male	17	55	42	34	13	69	45	31	31	92	47	32	39
Female	17	33	13	11	18	32	11	3	34	57	6	1	40
Unknown										161	1		156
Total	34	88	55	45	31	101	56	34	65	310	54	33	235

Table 1. Lesser Stag Beetle sightings during 2009-2011, Colchester, Essex.

Figure 1. Male Lesser Stag Beetle, left, 30.07.2010, and, right, on 09.05.2011 respectively 368 and 666 days after its first capture on 12.07.2009. Note a couple of punctures on both wing cases – number 14; they have been marked over in 2010.

The only female captured feeding was also a resident; she was recaptured there three times during 36 days. No females from previous years were recaptured.

1.2 *Acer negundo* tree

As it is shown in Table 1, the total number of sightings on this habitat was very high; 235, the majority (156) being of unknown sex, due to the fact that they were either too far away to be identified properly or to be captured.

The Lesser Stag Beetles came out through gaps in the bark and crawled on the tree when it was dark, especially on warm nights. They seemed to move in and out with great ease and even frass (a mixture of splintered wood and faecal pellets) came out through some of the gaps. On one occasion, 13 June, 19 individuals could be viewed from the pavement.

There was no sex bias judging from the captures: 39 males to 40 females; only one mating was observed.

Four males and four females were recaptured there, at least once. And, as has been mentioned, one male travelled to the cherry stumps.

No Lesser Stag Beetles have ever been seen on the wing, even though freshly alighted individuals have been spotted over the years.

2 Rearing experiments

During their activity period, both male and female Lesser Stag Beetles came readily to feed on maple syrup but the females also fed on the carcass of the female Stag Beetle. After intensively chewing on the soft tissue of the carcass, they sipped the liquid parts. The males were not seen feeding on the carcass.

The males caught during their activity period in the wild in 2009 were rather long-lived. One of them died in the autumn of 2011; he was active for two years. The other male died the following year, 19 July, having been active for three years.

The lifespan of the females which were caught when in their pupal cells in 2009 was different. One female laid eggs only in her first season and died on 23.06.2011. She lived one year and eight months. The second female was kept apart in order to establish the offspring she would produce. At the end of the first season in September 2010, 33 larvae were found; at the end of the second season in 2011 only 12 larvae were found. She died on 20.08.2011; she lived one year and 10 months.

Discussion

The recapture of a male Lesser Stag Beetle from 2009, right at the beginning of the season, was like winning a lottery ticket. This recapture after a record 666 days has proved that in the wild this species can be active for three seasons.

Altogether, since these field studies started, there have been four male recaptures on the patches of individuals from the previous season, all at least two years old. Unfortunately, when they were first captured they were not checked for wear and tear. For example, a good wear and tear indicator is the state of their setae (body hairs) particularly in the surrounding edges of the pronotum with the head and the elytra; on the second year, the setae are less visible and not so brightly yellow as in the first year. These rather subtle details would have been very difficult to ascertain in field conditions.

The continental males were checked for wear and tear and looked as though they might already have lived for quite some time in the wild. Nevertheless, they were active in captivity during two to three years and this fits with the field results.

The longevity of various large *Dorcus* species has been known for a long time by breeders; currently some species may live in captivity for two-and-a-half to three years (Lai & Hsin-Ping, 2008). In Japan some *Dorcus* species are also popular pets precisely because of their longevity

(Howard Mendel, pers. commun.). Our data suggests that our *D. parallelipedus* males had a similar lifespan. Not so the females.

There has been only one female recapture from a previous season during 2010. This female was first captured on a stump 12.08.2009, and was found dead 297 days later in an alleyway, just over a garden wall; she had been trodden on (Fremlin & Hendriks, 2011).

The captive females were not as long lived as the males. Of course, this is very scant data, but the differences in lifespan between these two sets of males and females raise the question whether the females lived shorter because of their energy-consuming egg-laying activity.

Regarding their feeding behaviour, in the field there were far fewer female sightings on the syrup patches. However, on the living *Acer negundo,* males and females came out in roughly equal numbers and this is a somewhat puzzling observation. It does not fit with the observations on the patches, perhaps because on that tree trunk there was no artificial food source. However, this tree is host to various fungi and, given the fact that in places frass is coming out through the bark, the population in the trunk might be dense. This can lead to more females that are searching for less crowded places to lay their eggs. In doing so they might occur more often on the surface.

In any case, this colony is perhaps thriving on the mycelia inside the trunk and even resorting to cannibalism (Tanahashi &Togashi, 2009; Tanahashi *et al.,* 2009); both would boost the protein intake in their diet. Indeed, all the fungi in that part of the trunk of the *Acer negundo* are associated with white-rot and it is well known that *Dorcus* species favour it (Tanahashi *et al.*, 2009).

Another example of a Stag Beetle which favours white-rot is the Australian Rainbow Stag Beetle *Phalacrognathus muelleri.* This tropical species breeds in rotting wood of both fallen and standing, living or dead trees. It seems to be able to complete its entire life cycle within the dead parts of living trees (Wood *et al.* 1996) and we believe that might also be the case with *D. parallelipipedus* in that colony.

In captivity both sexes took the syrup, but only the females fed on the carcasses, first in an earlier experiment (Fremlin & Hendriks, 2011) and then in 2011.

This suggests that the females might need an even higher protein diet to benefit their egg production and longevity. Breeders have managed to extend the fertility of *Dorcus curvidens* by feeding the females with a very high protein diet, either using the pupae of the Japanese Rhinoceros Beetle *Allomyrina dichotoma*, reared for the purpose, or the squeezed

out contents of the guts of crickets and meal worms. That way they may lay up to 60 eggs, if allowed to rest between each egg-laying session, and live for two years when kept at constant temperature; they could live longer if allowed to hibernate. Once active, some *Dorcus* species may live one-and-a-half to three years in captivity (Lai & Hsin-Ping, 2008).

Therefore the experiment with the egg production of individual females is to be continued. This might make it possible to prove if a significant difference in lifespan between males and females does exist.

Conclusion

The often overlooked Lesser Stag Beetle, which has been living in the Colchester area for a very long time (fossil remains from Cudmore Grove Country Park, 16 km away, date back to more than 300,000 years* ago (Roe *et al.,* 2009)) seems to have a very interesting life history. This was a very rewarding study.

In the UK the Rhinoceros Stag Beetle, *Sinodendron cylindricum*, seems to have a rather different life history from *L. cervus.* In this species both sexes work together during the nest preparations, perhaps like some dung beetles: the male guards the nest while the female lays the eggs (Arrow, 1951). This behaviour would be rather interesting to observe.

* correction: 30,000 years

Acknowledgements

We wish to thank Dr Masahiko Tanahashi for information about the Japanese *Dorcus* species. As the Rhinoceros Stag Beetle seems to be missing in the Colchester Stag Beetle hotspot, MF would be grateful to hear from someone who knows of a good colony in the UK.

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The Wonderful Puss Moth – Hiding in the Basket Willow

Puss Moth Rap

Hey, – so you think I look great
Tho' I'm only a fake
But Give me a break
That freak with a beak
Is after my meat!

I'm an eating machine
On anything green
In a race to pupate
In a hidden cocoon
I must fatten up soon

While I'm busy with food
I can't see that dude
Whose avian eye
Is all set to spy
On my every move!

When he swoops to attack
I'll fight him right back
With my fake monster act.
I'll puff up my head
And stare in his face
With a terrible gaze
He'll wish he was dead

I'll flash my forked tail
Like an angry snake's tongue
And give such a scare
He can't wait to be gone.
Then I'll flail their red tassels
In front of his eyes
He'll never know
It's a **wicked** disguise

I know it's a fake
But just wait a minute
It's a really neat trick
In'it?

Lynne Flower – June 2012

Letter from Spain – 19th in a series – British Immigrant Lepidoptera found in Andalucia. Part 3 – the Geometridae

by David Keen (3309L)

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In parts 1 and 2 of this review I gave details about the area in which I live, of Andalucia in general and of the light trap that I run – thus I will not repeat these here. As in part 2, in addition to the moths that Bernard Skinner describes as immigrants, I will also include information relating to extinct or species with an uncertain status where appropriate. This information will, once again, be gleaned from locally published books and my own observations. I will often refer to the books by Manuel Diaz and V M Redondo *et al.* – see under references below. The former is in Spanish and covers only 86 species of this Family as part of a general review of the Lepidoptera (Macro and Micro) of the area, but the latter is in Spanish and English and covers 589 species in much greater detail.

As before, I will review each species in the order in which they appear in Bernard's book starting with his first immigrant species, the Rest Harrow *Aplasta ononaria*, which he describes as a resident and suspected immigrant. Diaz says that there is an established colony in the sierra de Malaga mountains where it flies in the month of July. He assumes that it is also present in other mountain areas in Andalucia but there is little information about its distribution in print. Redondo shows on the distribution map that there are colonies in or near the mountains along the coast of Andalucia from Cadiz in the west to Almeria in the east. He says it is found from sea level to 2250 m from June to August – the caterpillars feed on *Cytisus* and *Genista*. I have yet to find it down here.

The next species is the Sussex Emerald *Thalera fimbrialis*, which is described as an immigrant and transitory resident. Diaz says that he has found it in August at high altitude in the Province of Granada (I assume he is referring to the Sierra Nevada). Redondo confirms the Granada site but says that in other parts of Spain it can be found from July to September. He gives the larval food plants as *Senecio, Artemisia, Thymus, Prunus, Crataegus, Rumex* and *Galium* among other plants. It is not a species that I have come across.

Blair's Mocha *Cyclophora puppillaria*, is the next immigrant. This is, as Diaz says, a very common species in Andalucia where it flies from the end of spring right through to October or even November. He confirms that it readily comes to light and is often found during the day resting below street lights, on window sills, etc. Redondo says that the adult is